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Actions speak louder than words in socially foraging human groups

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Social foraging in humans has a deep evolutionary history: early hominids searched for dispersed food sources in a patchy, uncertain environment. A fundamental assumption is that social foragers benefit by exchanging information about food sources, in order to make collective decisions based on pooled information. We conducted the first experimental test of this assumption, and showed that, as predicted, communication significantly enhanced group performance. A further, unexpected result was that physical communication through gesturing, rather than verbal communication, appeared to play a crucial role in the early stages of group interaction, facilitating consensus decision making by groups. The importance of gestures in human interactions may therefore be underestimated, and this has important implications for modern human societies, where communications are becoming increasingly dominated by virtual modes of communication that preclude the use of gestures.

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The Evolutionary Significance of Communication in Human Groups

When observing human foraging behavior in traditional societies, we typically see groups of individuals moving through their environment, making decisions about how to obtain resources, and then returning to a central location with the fruits of their labor. This social foraging has a deep evolutionary history: early hominids will have faced the equivalent problem of finding dispersed food sources in a patchy savannah environment. The patchiness of resources increases 'uncertainty', and it is hypothesized that individual search costs can be reduced, and group performance improved, if a number of foragers cooperate by exchanging information about encountered food items.[1]

To our knowledge this fundamental assumption had never been tested. Since modern humans encounter equivalent spatial-temporal coordination problems on a daily basis to early hominid groups, we constructed teams of 2–8 people—visitors to ZSL London Zoo—and tested the longstanding assumption that communication enhances group performance in humans.[2]

Communication Significantly Enhances Group Performance

We created a physical foraging arena with 6 foraging patches of differing quality arranged in a circle (**Fig. 1A**). Each patch contained different proportions of two forage types—'high quality cards', which were green and 'low quality cards' which were white. Groups of people were challenged to collect as many green cards (high quality) as possible and deliver them to a 'home-base', which was located at the center of the six foraging patches. The experiment was run 43 times, with 22 teams being permitted to communicate by talking or gesturing, and 21 teams asked not to communicate in any way. We encouraged collective participation by promising a prize to each individual in the best performing group. We measured individual and team performance (number of cards collected over time) using radio-frequency identification tags, while recording level of verbal communication with a decibel

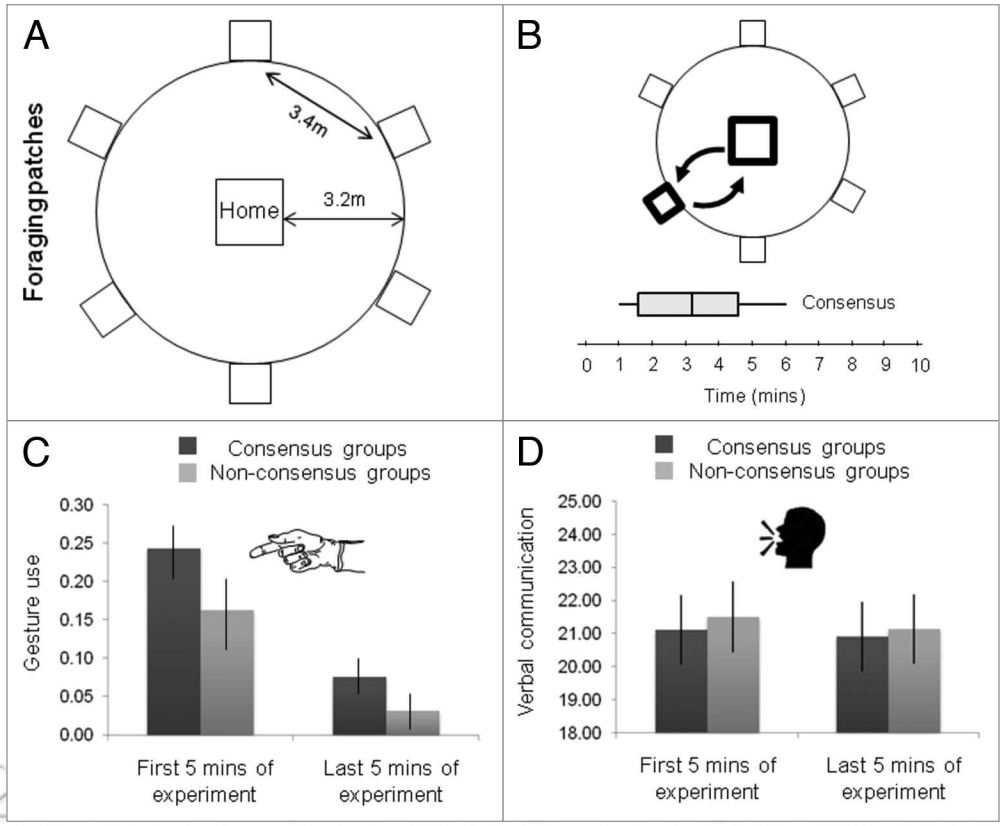

Figure 1. (A) Physical foraging arena with six foraging patches of different quality. (B) Box plot showing mean (middle line), inter-quartile range (box) and full range (extended lines) for consensus decision times in communicating groups (15 of 22 groups). Consensus was reached when all individuals converged to forage on the single most profitable patch, as indicated by arrows in the diagram. (C) Mean ± standard error gesture use (gestures per group member per minute) during the first half, and second half of the experiment. Groups that reached consensus used gestures more than groups that did not reach consensus (King et al. 2011), and their use coincided with the timing of consensus decisions (B). (D) Mean ± standard error decibel (dB) reading (after controlling for group size) for communicating groups that reached consensus (dark gray, n = 15) and those groups that did not (light gray, n = 7).

meter, and measuring the number of gestures occurring. Our real-time automatic monitoring methods also allowed us to determine the time point at which group consensus had been reached, with all individuals converging on the single most profitable patch (**Fig. 1B**).

As predicted by theory, the communicating groups collected a higher proportion of high quality cards than non-communicating groups, and this effect was independent of group size, familiarity between group members, or gender composition of groups. Communicating groups performed well because they reached consensus (15 of 22 groups), while non-communicating groups rarely managed to achieve consensus (3 of 21 groups). These findings therefore provided the first experimental proof that communication enhances group coordination in humans.

The Importance of Gestures in Human Communication

Humans are more skilled than other animals at discerning what others are perceiving, intending, desiring, knowing, and believing[3]—allowing group decision-making based on mutual discussion.[4] We therefore expected the performance of the communicating groups in our study to be attributed to the ability to verbally tell one another what is going on, and thus quickly assess the quality of the foraging patches. But unexpectedly, it appeared that the level of gesturing—and not the amount of discussion among group members that went on—was vital to communicating groups achieving consensus. We found gesture usage by communicating groups was significantly higher in the first stages of the experiments, and actually tended to peak at the time at which consensus was reached (**Fig. 1C**). Notably, this pattern was not detected in usage of verbal communication (**Fig. 1D**). Gesture use, therefore, appeared to be a critical form of communication in the initial stages of our social foraging experiments.

Our findings might therefore demonstrate the importance of gestures for human group coordination in a broader context, and provide novel insights into the significance of gestural communication in both ancestral and modern-day human societies.[5,6] Since language is based on the same underlying cognitive and social skills that facilitate collaborative activities in the absence of explicit communication,[3,7] our experimental results compliment studies of human collective behavior in other contexts. Recent works on human crowds have demonstrated that complex patterns of human collective behavior can occur in the absence of explicit signaling, with

people attending to only very simple, and local movement cues.[8,9]

It is intriguing that gesticulations emerged as a key mechanism, when human society today is undergoing rapid changes in the way we communicate. We rely increasingly on computer-based communication that precludes the use of body language, (e.g., email, Twitter, online social networking and virtual worlds) and this may have important consequences for our performance as social animals. Indeed, joint attention—using visual cues to direct the attention of an individual to a specific object—can dramatically improve the success of communication and absence of visual interaction may limit cooperation.[10] Technological advances in modern communication systems that allow us to compensate for loss of vital cues, e.g., 'red-flagged items' on emails, 'pokes' on social networking sites, will be essential as our societies become more reliant on virtual interactions for achieving common goals.

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